Sonic Boom Vibro-Acoustic Simulations using Multiple Point Sources, Phase I

Completed Technology Project (2009 - 2009)

Project Introduction

AVEC proposes an innovative concept for the evaluation of human response studies to sonic booms inside realistic structures. The approach proposed is to simulate the distributed boom load on the structure using an array of discrete forces. The forces are applied sequentially making the approach effective and implementable in real structures. In addition, the method allows evaluating the contribution of individual structural components to the vibro-acoustic responses. The main goal of Phase I is to experimentally demonstrate the approach in a realistic environment. Phase II efforts should involve the experimental validation of the proposed technology in a real house subjected to real sonic booms. Fortunately, this data set exists and corresponds to the latest field test performed by NASA at Edwards Air Force Base (AFB) property. This will imply implementing the proposed method to the same house (preferred) or a similar one and use the outside pressure profile and direction to estimate the same vibro-acoustic responses measured by NASA in 2007. Comparison of the predicted and measured responses will provide the best validation of the approach. In support of this "real" validation of the method, a numerical model to better understand and improve the excitation methods should also be part of Phase II. At the conclusion of Phase II, it is expected that the method will be fully validated and ready for implementation on a range of structures for evaluating the human response to sonic booms as required by current industry needs. According to technology readiness levels (TRLs) guidelines, at the end of Phase II a TRL level of 6 would be achieved, i.e. system model/prototype demonstration in a relevant environment.

Anticipated Benefits

There are a number of potential commercial opportunities for the technology proposed here. Obviously, the first potential clients are the industries directly involved in the development of supersonic business aircraft, e.g. Gulfstream, Lockheed, and so forth. In this sense, the developed technique/system can be commercialized as a service or turn-key product. Another potential commercialization market for the system is related to auditory protection of personnel exposed to explosions. For example, there is a need to assess and control the impact of impulsive noise (explosives) to military personnel inside different type of vehicles. The same technology proposed here can be used to estimate the response inside military vehicles, e.g. land, amphibious, etc. There is a clear increasing demand for supersonic commercial airplanes that can fly overland. This will be possible only if current restrictions are lifted. To this end, the human response inside buildings to the expected weak sonic boom will need to be accurately estimated. The proposed method here will provide a validated synthesis/auditory tool for the evaluation of human objection to these types of sonic booms in real structures.

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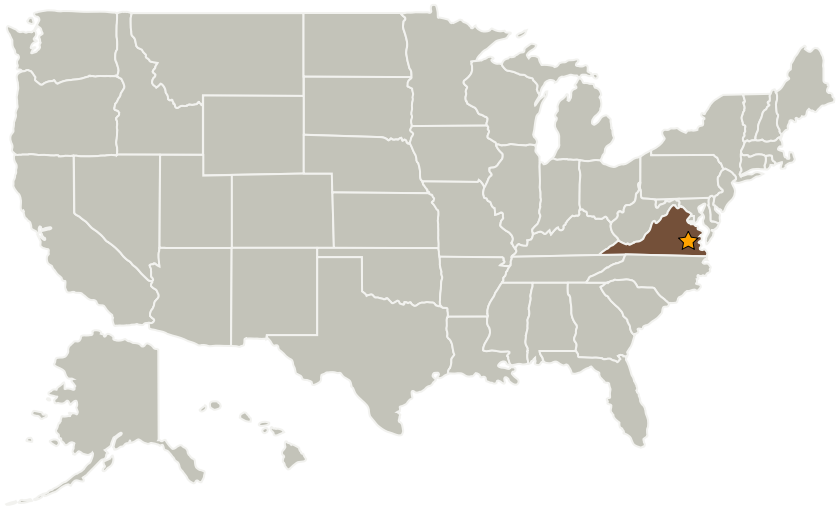
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Langley Research Center(LaRC)	Lead Organization	NASA Center	Hampton, Virginia
AVEC, Inc.	Supporting Organization	Industry	Blacksburg, Virginia

Primary U.S. Work Locations
Virginia

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Langley Research Center (LaRC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Project Manager:

Jacob Klos

Principal Investigator:

Patricio Ravetta

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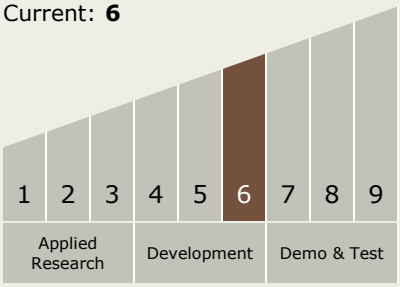
Technology Maturity (TRL)

Start: **6**
Current: **6**



Technology Areas

Primary:

- TX15 Flight Vehicle Systems
  - TX15.1 Aerosciences
    - TX15.1.4 Aeroacoustics